FILED
U.S. DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MAY - 5 2000
DAVID J. MALAND, CLERK
BY DEPUTY

UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

SULZER TEXTIL A.G. and SULZER TEXTILE, INC.	§	
Plaintiff,	§	
VS.	§	CASE NO. 6:00CV279
	§	COMPLAINT FOR PATENT
PICANOL NV,	§	INFRINGEMENT
	§	JURY DEMAND
Defendant.	§	

PLAINTIFFS' ORIGINAL COMPLAINT

Plaintiffs, Sulzer Textil A.G. and Sulzer Textile, Inc. (collectively "SULZER"), for their Complaint against Defendant PICANOL NV ("PICANOL") allege:

THE PARTIES

1. Plaintiff, Sulzer Textil A.G. is a corporation duly organized and existing under the laws of Switzerland and has a place of business at CH-8630 Rüti, Switzerland.

2. Plaintiff, Sulzer Textile, Inc., is a corporation duly organized and existing under the laws of the State of South Carolina, and has a place of business at Spartanburg, South Carolina.

3. SULZER is informed and believes, and on that basis alleges that Defendant, Picanol NV is a corporation organized under the laws of Belgium with a place of business at Polenlaan 3-7, 8900 Ieper, Belgium.

JURISDICTION

4. This Court has subject matter jurisdiction pursuant to 28 U.S.C. § § 1331 and 1338(a) because this action arises under the patent laws of the United States, including 35 U.S.C.

§ 271 *et seq.* The Court has personal jurisdiction over Defendant in that Defendant has established minimum contacts with the forum and the exercise of jurisdiction over Defendant would not offend traditional notions of fair play and substantial justice.

VENUE

5. Venue is proper in this District pursuant to 28 U.S.C. § 1391(d).

INFRINGEMENT OF U.S. PATENT NO. 4,450,876

6. SULZER incorporates by reference and realleges paragraphs one through five above.

7. On May 29, 1984, United States Patent No. 4,450,876 (the '876 patent) was duly and legally issued for an invention entitled Method for Weaving on a Weaving Machine Operating with a Blowing Nozzle for a Flowing Transport Fluid. Plaintiff, Sulzer Textil A.G. is the assignee and owner of the '876 patent.

8. Sulzer Textile, Inc. has exclusive right to the '876 patent. The '876 patent is presumed valid pursuant to 35 U.S.C. § 282. A true and correct copy of the '876 patent is attached hereto as Exhibit A and incorporated herein by referenced.

9. Upon information and belief PICANOL has infringed and continues to infringe, has induced and continues to induce others to infringe, and has committed and continues to commit acts of contributory infringement of the '876 patent. The infringing acts include, but are not limited to the importation, sale and/or offer for sale of weaving equipment and associated spare parts in the United States. PICANOL is liable for infringement of the '876 patent pursuant to 35 U.S.C. § 271.

10. PICANOL's acts of infringement have caused damage to SULZER and SULZER is entitled to recover from PICANOL the damages sustained by SULZER as a result of PICANOL's wrongful acts in an amount subject to proof at trial.

11. PICANOL's infringement of SULZER's exclusive rights under the '876 patent will continue to damage SULZER's business, causing irreparable harm, for which there is no adequate remedy at law unless it is enjoined by this Court.

12. Upon information and belief PICANOL's infringement of the '876 patent was willful and deliberate, entitling SULZER to increased damages under § 284 (up to three times) and to attorneys' fees and costs incurred in prosecuting the action under 35 U.S.C. § 285.

INFRINGEMENT OF UNITED STATES PATENT NO. 4,446,893

13. SULZER incorporates by reference and realleges paragraphs one through five above.

14. On May 8, 1984, United States Patent No. 4,450,893 (the '893 patent) was duly and legally issued for an invention entitled Method for Transporting a Weft Thread Through the Weaving Shed of a Weaving Machine Through the Intermediary of a Flowing Fluid, and Weaving Machine Adapted for the Application of this Method. Plaintiff, Sulzer Textil A.G. is the assignee and owner of the '893 patent. Sulzer Textile, Inc. has exclusive right to the '893 patent. The '893 patent is presumed valid pursuant to 35 U.S.C. § 282. A true and correct copy of the '893 patent is attached hereto as Exhibit B and incorporated herein by reference.

15. Upon information and belief PICANOL has infringed and continues to infringe, has induced and continues to induce others to infringe, and has committed and continues to commit acts of contributory infringement of the '893 patent. The infringing acts include, but are not

limited to the importation, sale and/or offer for sale of weaving equipment and associated spare parts in the United States. PICANOL is liable for infringement of the '893 patent pursuant to 35 U.S.C. § 271.

16. PICANOL's acts of infringement have caused damage to SULZER and SULZER is entitled to recover from PICANOL the damages sustained by SULZER as a result of PICANOL's wrongful acts in an amount subject to proof at trial.

17. PICANOL's infringement of SULZER's exclusive rights under the '893 patent will continue to damage SULZER's business, causing irreparable harm, for which there is no adequate remedy at law unless it is enjoined by this Court.

18. Upon information and belief PICANOL's infringement of the '893 patent was willful and deliberate, entitling SULZER to increased damages under § 284 (up to three times) and to attorneys' fees and costs incurred in prosecuting the action under 35 U.S.C. § 285.

JURY DEMAND

19. Plaintiff's, SULZER TEXTIL A.G. and SULZER TEXTILE, INC., respectfully request a jury trial on all issues.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff, SULZER, prays for judgment and seeks relief against PICANOL as follows:

(a) For judgment that the '876 and '893 patents have been and continue to be infringed by PICANOL;

(b) For an accounting of all damages sustained by SULZER as the result of PICANOL's acts of infringement;

(c) For preliminary and permanent injunctions enjoining the aforesaid acts of infringement by PICANOL, their officers, agents, servants, employees, subsidiaries and attorneys, and those persons acting in concert with PICANOL, including related individuals and entities, customers, representatives, OEMs, dealers, distributors;

(d) For actual damages, together with prejudgment interest, according to proof;

(e) For enhanced damages pursuant to 35 U.S.C. § 284; and

(f) For an award of attorneys' fees pursuant to 35 U.S.C. § 285, or as otherwise permitted by law.

Respectfully submitted,

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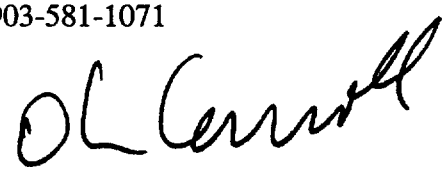
By: 

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ATTORNEYS FOR PLAINTIFFS,
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and SULZER TEXTILE, INC.

United States Patent [19]
van Mullekom

[11] 4,450,876
[45] May 29, 1984

[54] METHOD FOR WEAVING ON A WEAVING MACHINE OPERATING WITH A BLOWING NOZZLE FOR A FLOWING TRANSPORT FLUID

[75] Inventor: Hubert P. van Mullekom, Deurne, Netherlands

[73] Assignee: Ruti-te Strake B.V., Netherlands

[21] Appl. No.: 390,850

[22] Filed: Jun. 22, 1982

[30] Foreign Application Priority Data

Jul. 2, 1981 [NL] Netherlands 8103184

[51] Int. Cl.³ D03D 47/30
[52] U.S. Cl. 139/435; 139/450
[58] Field of Search ..... 139/1 R, 435, 336.4, 139/450; 242/27, 28, 29; 226/97; 66/137 R

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3,236,265 2/1966 Brookshire 139/450
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4,362,189 12/1982 Brower et al. 139/336

FOREIGN PATENT DOCUMENTS

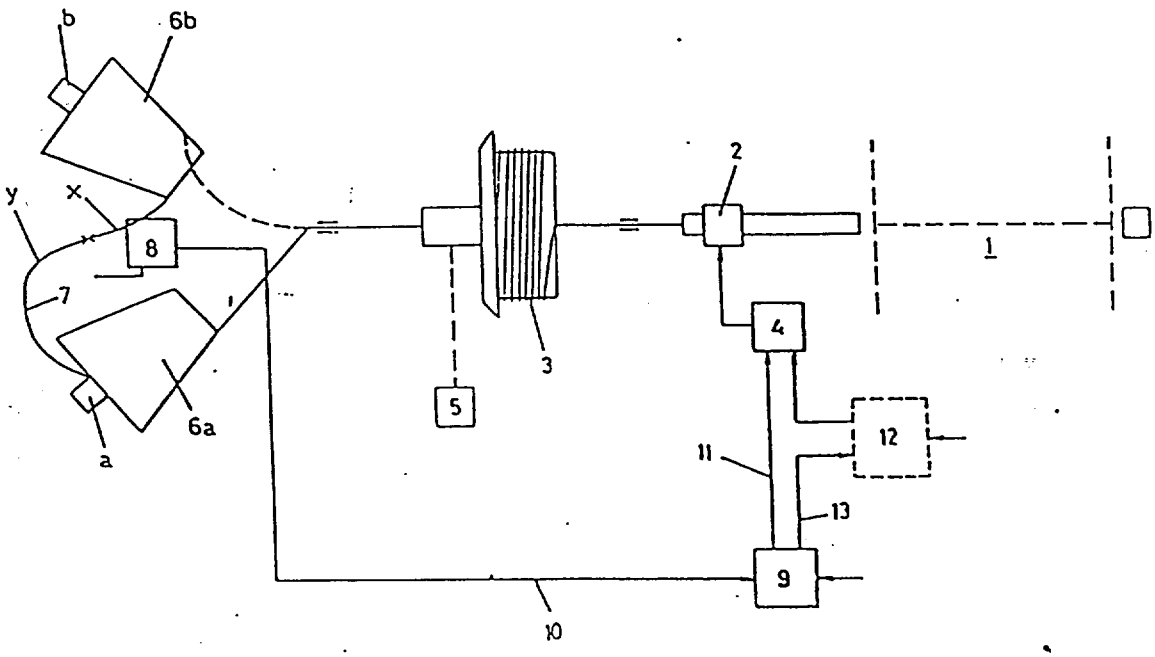
1092947 11/1967 United Kingdom 139/450

Primary Examiner—Henry Jaudon
Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis

[57] ABSTRACT

The impulse transmission of the transporting fluid to the weft yarn may be different, also with yarns of the same type, through different causes, particularly when a switching takes place from one yarn packet to a next yarn packet. According to the invention this switching is now detected in that the yarn section constituting the connection between both packets moves past a detector which emits a signal whereby the feed pressure for the blowing nozzle launching the weft threads into the weaving shed is temporarily varied.

3 Claims, 1 Drawing Figure



METHOD FOR WEAVING ON A WEAVING MACHINE OPERATING WITH A BLOWING NOZZLE FOR A FLOWING TRANSPORT FLUID

The invention relates to a method for weaving on a weaving machine operating with a blowing nozzle for a flowing transport fluid, in which the weft threads are measured and withdrawn from successive yarn packets.

In weaving machines in which the transport of the weft yarn through the weaving shed takes place through the intermediary of a flowing fluid, generally air, differences may occur due to different causes in the impulse transmission from the transporting fluid to the weft yarn. So the impulse transmission with smoother yarn is less effective than with the more fibrous yarns. In this case there are clear causes which may be traced back to differences in surface condition with different types of weft yarns. Besides, however, there are also cases in which the causes are less clear, e.g. if differences in weft time are established, which must be attributed to variations in the impulse transmission, with weft threads of the same type of yarn which are transported under seemingly equal circumstances.

Proposals have already been made for compensating the variations in the impulse transmission of the transport fluid to the successive weft threads, occurring with the same type of weft yarn, by automatically adapting the feed pressure of the blowing nozzle and/or automatically adapting the machine number of revolutions, in order thereby to achieve an approximately constant weft time or a weft time which is a substantially constant portion of the momentary weft cycle time which is determined by the number of revolutions. In this connection reference may be made to the proposal described in the Dutch patent application No. 7908357.

Further experiments now have led to the recognition that, beside a more trendlike variation in the impulse transmission, although seemingly spontaneous changes in impulse transmission may occur and that a variation of this last mentioned type particularly may be expected around the moment in which the relative weft yarn packet has been consumed and the switch is made to a next yarn packet which earlier has been arranged by the weaver ready for use in a reserve station of the machine and therefore was tied with its head end to the tail end of the yarn packet being in use. The invention now aims at compensating the influence of the yarn packet change on the weft time interval.

According to the invention this aim is achieved in that the switching to a next yarn packet is detected and as a reaction to the detection signal a temporary change of the feed pressure of the blowing nozzle is caused.

Generally the switching to the reserve yarn packet will tend to temporary increase the weft time so that then in accordance with the proposal of the invention a temporary increase of the feed pressure of the blowing nozzle will have to be applied.

In a practical embodiment the yarn section that constitutes the connection, after the tying together, between the yarn packet being in use and the reserve yarn packet, is placed in a position from which the weft yarn may be withdrawn when the switching to the reserve packet takes place, through a detection zone in the direction of the blowing nozzle.

The invention likewise relates to a weaving machine whereby the method as described above may be performed.

The weaving machine according to the invention comprises at least one blowing nozzle, fed by a flowing transport fluid, for transporting the weft yarn through the weaving shed, and a weft preparation device which measures the successive weft threads and withdraws them from a stationary yarn packet, besides that yarn packet provisions being present for supporting a reserve yarn packet. The machine according to the invention is characterized by a detection device positioned in the zne between those yarn packets in such a position that the yarn section bridging the yarn packets tied together is drawn, when the switching takes place of the packet being in use to the reserve packet, along the detection device, the output of said detection device being connected to the control element for the feed pressure of the blowing nozzle.

The invention is hereunder further illustrated with reference to the schematic drawing of an embodiment given as an example.

In the FIGURE the portion of the weaving machine containing the weaving shed is schematically indicated by the reference number 1. Reference number 2 indicates the blowing nozzle arranged at one end of the weaving shed, to which nozzle on the one hand the weft yarn i is supplied by the weft preparation device 3 and which on the other hand is fed with a flowing fluid, e.g. pressurized air, from a system 4 comprising a source for the relative fluid and the corresponding control means, such as a pressure reduction valve. The drive of the weft preparation device 3 is derived in known manner from the main drive 5 which has been schematically indicated. The device 3 withdraws the weft yarn from a stationary yarn packet *6a* constituted by a cone received on a support shaft a. Beside the yarn packet *6a* a reserve yarn packet *6b* has been provided which is received on a second support shaft b and the head end x of which has been tied to the tail end y of the yarn packet *6a*. Both yarn packets *6a* and *6b* thereby are mutually connected by a yarn section 7.

In the area between the yarn packets an e.g. electrically operated detection device 8 has been provided. The drawing shows the situation in which the yarn section 7 has been placed by the weaver in a leaving position in the detection device 8. As soon as now the yarn packet *6a* has been consumed the yarn section is drawn from the detection device along the yarn path indicated with broken lines and the switch is made to the reserve packet *7b*. Therewith the pick-up (not further shown) of the detection device is passed which generates a signal which is supplied to an electronic circuit 9. Said circuit is adapted to supply, as a reaction to the received signal 10, during a predetermined, if necessary adjustable time interval, a control signal to the system 4. Thereby the pressure reduction valve belonging to the system 4 is adjusted during that time interval to a different, e.g. higher value which likewise may be adjustable in dependence on the yarn to be used and on other parameters.

The drawing further shows an electric control circuit 12 which during normal weaving operation controls the feed pressure of the weft transporting device 2. The influence of said circuit which may be in the embodiment according to the principle as described in the Dutch patent application No. 7908357, may be deleted during the operative period of the circuit 9 thrugh a signal 13 emitted by the circuit 9.

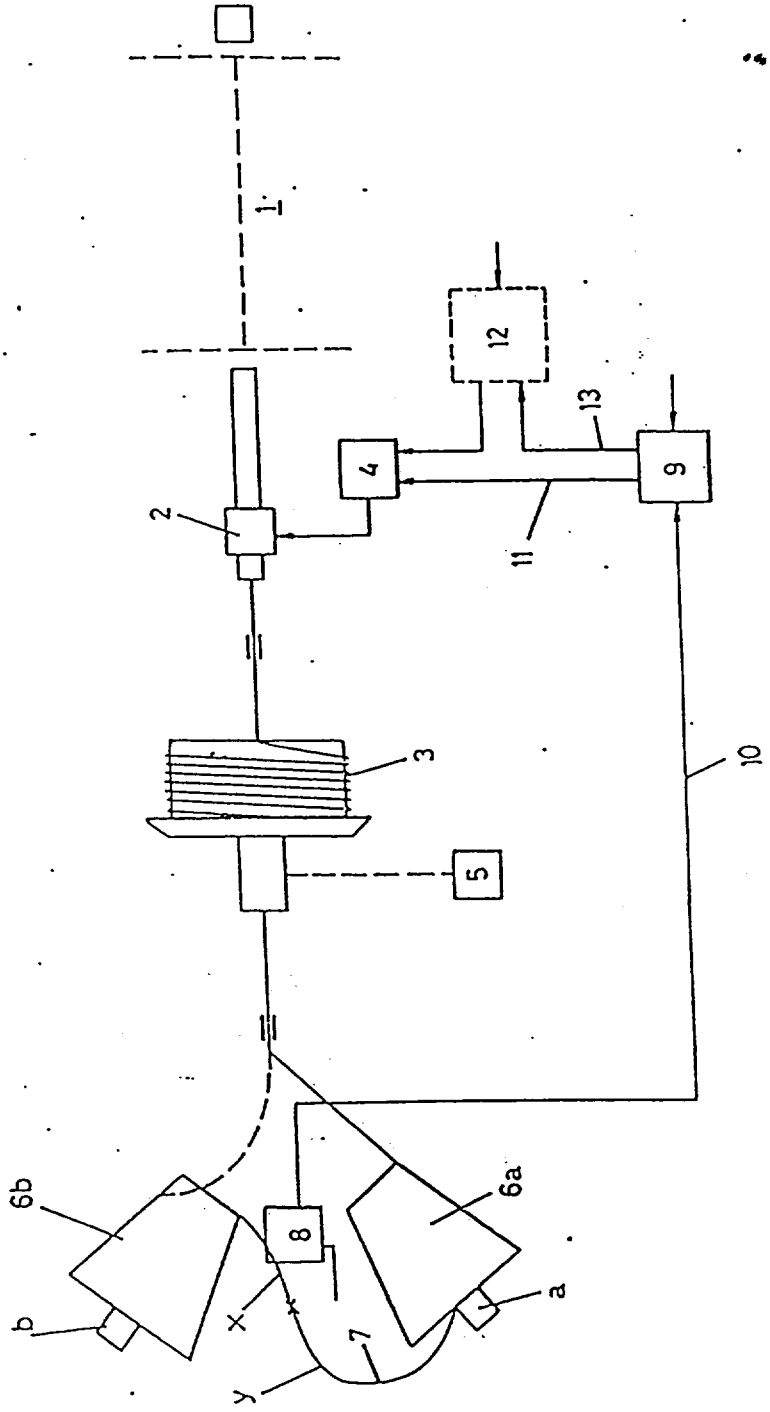
I claim:

1. A method for weaving on a weaving machine operating with a blowing nozzle for a flowing transport fluid, in which weft threads are measured and withdrawn from successive yarn packets, characterized in that the switching to a next yarn packet is combined with a temporary change in the feed pressure of the blowing nozzle.

2. A method according to claim 1 characterized in that the yarn section which, after the typing up, constitutes the connection between the yarn packet being in use and a reserve packet, is placed in a leaving position from which the weft yarn is caused to be withdrawn via a detection zone when switching to the reserve packet takes place.

3. A weaving machine comprising at least one blowing nozzle fed by a flowing transport fluid, for transporting the weft yarn through the weaving shed, and a weft preparation device measuring the successive weft threads and withdrawing them from a stationary yarn packet, in which besides a yarn packet provisions are present for arranging a reserve yarn packet, characterized by a detection device arranged in the zone between both yarn packets in such a position that the yarn section bridging the yarn packets which have been tied together, is drawn, when the switch is made from the packet being in use to the reserve packet, along the detection device, the output of said detection device being connected to the control element for the feed pressure of the blowing nozzle.

* * * * *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6a
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United States Patent [19]

Gunneman et al.

[11] 4,446,893

[45] May 8, 1984

[54] METHOD FOR TRANSPORTING A WEFT THREAD THROUGH THE WEAVING SHED OF A WEAVING MACHINE THROUGH THE INTERMEDIARY OF A FLOWING FLUID, AND WEAVING MACHINE ADAPTED FOR THE APPLICATION OF THIS METHOD

[75] Inventors: Paul Gunneman, Mierlo; Gerardus W. Jeuken, Deurne, both of Netherlands

[73] Assignee: Ruti-Te Strake B.V., Deurne, Netherlands

[21] Appl. No.: 205,013

[22] Filed: Nov. 7, 1980

[30] Foreign Application Priority Data

Nov. 15, 1979 [NL] Netherlands 7908357

[51] Int. Cl.³ D03D 41/00

[52] U.S. Cl. 139/11; 139/116; 139/435

[58] Field of Search 139/116, 435, 452, 370.2, 139/11

[56] References Cited

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4,298,172	11/1981	Hellstrom	139/452

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632773	11/1978	U.S.S.R.	139/435
735683	5/1980	U.S.S.R.	139/435

Primary Examiner—Henry Jaudon

Attorney, Agent, or Firm—C. O. Marshall, Jr.

[57] ABSTRACT

The speed of the movement of each weft thread through the shed is correlated with the speed of operation of the weaving machine by measuring the time occupied by movement of a weft thread through the shed, generating a first electrical signal which is a measure of such time, generating a second electrical signal which is a measure of a predetermined fraction of the time occupied by a weaving cycle of the machine, comparing said electrical signals and generating a third electrical signal which is a measure of the discrepancy between the first and second signals, and using the third signal to control one of such speeds in order to eliminate the discrepancy between the first and second signals.

6 Claims, 3 Drawing Figures

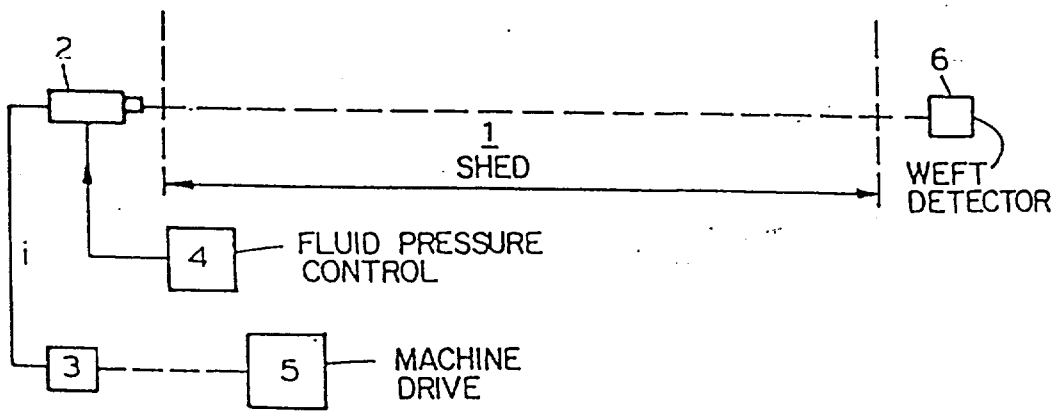


FIG.1

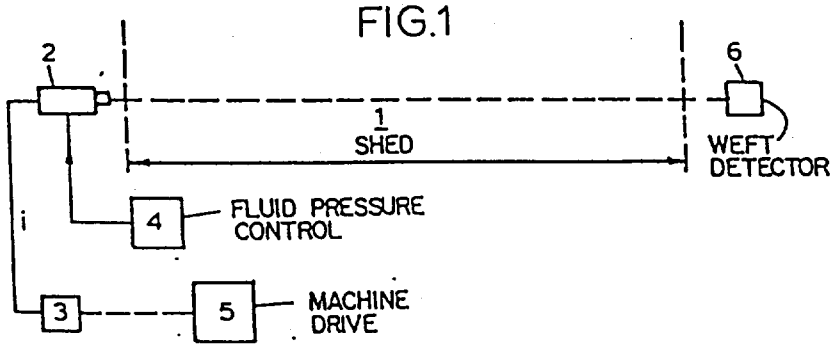


FIG.2

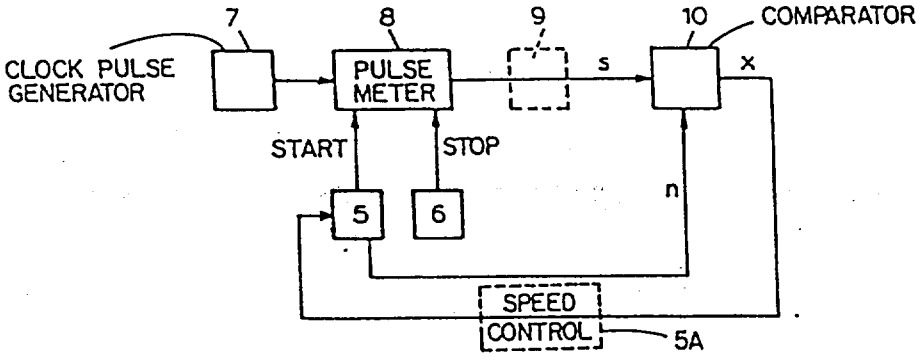
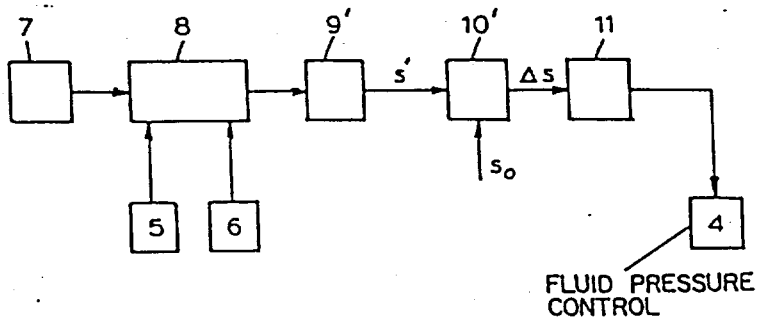


FIG.3



METHOD FOR TRANSPORTING A WEFT THREAD THROUGH THE WEAVING SHED OF A WEAVING MACHINE THROUGH THE INTERMEDIARY OF A FLOWING FLUID, AND WEAVING MACHINE ADAPTED FOR THE APPLICATION OF THIS METHOD

The invention relates to a method for transporting a weft thread through the weaving shed of a weaving machine through the intermediary of a plurality of nozzles fed with a flowing transport fluid.

In the present state of the art considerably higher transport velocities may be achieved with weft systems operating through a flowing transport fluid than with other types of weft transport systems. Particularly pneumatic weaving machines may thereby operate at considerably higher numbers of revolutions than weaving machines provided with different weft transport systems.

For obtaining as high as possible thread velocities in the weft transport through a flowing fluid one is dependent on a correct pulse transmission of the transport fluid to the weft yarn. Many structural measures have already been proposed in order to optimalize the conditions for the best possible pulse transmission with yarns of different type (such as smoother yarns and more fibrous yarns). It is also known to adapt the machine to a new weft yarn if in such a weft transport system a change is made to a different kind of weft yarn, e.g. by differently adjusting the pressure in one or more of the nozzles and adapting the number of revolutions of the machine to the velocities attainable with this new weft yarn.

Apart from the highest possible transport velocity of the weft yarn it is at least as important for the correct and efficient operation of the weaving machine that the successive weft threads have finished their weft movement with the least possible variations on predetermined points of time within the complete weaving cycle. A weft thread arriving too early as well as too late within the relative weaving cycle at the end of its weft movement may produce errors in the cloth. In practice therefore up till now the operation is such that within the weaving cycle a so wide time tolerance for the weft is permitted and so much transport fluid energy is supplied that one is practically sure that the slowest as well as the quickest weft thread will remain within this marginal difference. However, this method of operation is far from economical.

Therefore the invention aims at proposing measures for removing this disadvantage. Extensive experiments have led to the recognition that the differences found in weft periods and transport velocity respectively between successive wefts of the same weft yarn mainly originate in the yarn itself and particularly are the result of the variation in the air resistance of the yarn.

Using this recognition the invention now proposes to use the quantity which is representative for the behaviour of the weft yarn, such as its velocity, as the control quantity for controlling the weaving machine. Therein the operation may be according two different principles.

According to a first principle the transport velocity of each weft thread is measured, a signal, which is representative for the measured transport velocity, is supplied to a control system, in which this signal is converted into a control signal which changes the machine's number of revolutions per minute such that the time period necessary for the weft transport of a thread constitutes a substantially constant portion of the momentary weaving cycle time determined by the number of revolutions per minute. Thereby one achieves that the machine may operate at each moment with the highest possible number of revolutions, namely with a number of revolutions which is as high as permitted by the weft thread moving at that moment through the weaving shed.

According to a second principle the transport velocity of each weft thread is measured, a signal which is representative for the measured transport velocity is supplied to a control system, in which this signal is converted into a control signal which influences the components of the weft transport system governing the velocity of the weft yarn. Therein a constant number of revolutions per minute of the machine is used and one aims at obtaining a constant weft time period by said control.

A particular control according to the second principle is characterized according to the invention in that one carries out continuous measuring of the time used for the weft transport, determines the average weft time period of a number of successive wefts and compares this time with the desired weft time period, in which a signal which is representative for the time difference to be measured, is supplied to a control system in which this signal is converted into a control signal which influences the components of the weft transport system determining the velocity of the weft yarn.

In this manner the conditions for the most efficient use of the weaving machine are established in that e.g. at each point of time the nozzles are fed with only so much flowing fluid of such a pressure that the desired weft velocity is accurately produced. As soon as the continuous measuring of the weft time observes a decreasing trend of the weft time, this means that apparently less energy for the weft transport is necessary, whereafter a corresponding signal is supplied to the transport system until thereafter an increasing trend of the weft time is observed.

It has been found that in such a weft transport system, which automatically has a narrow control according to this method, the number of weft errors is essentially less and thereby the cloth quality is essentially improved.

Further by this method the possibility exists to have the machine automatically adjust itself to the new weft yarn when a change to a different type of weft yarn takes place, by simply supplying a new operation signal which is representative for the weft time period desired with this type of weft yarn.

The invention is illustrated hereunder with reference to the drawing showing two embodiments as examples.

FIG. 1 shows a diagram of a weaving machine of the type in which the weft transport takes place through the intermediary of a jet of a flowing fluid, such as water or air;

FIG. 2 shows a block diagram of a first embodiment of the control system according to the invention, to be applied to the machine according to FIG. 1, and

FIG. 3 shows a block diagram of the second embodiment of the control system according to the invention to be applied to the machine according to FIG. 1.

In FIG. 1 the portion of the weaving machine containing the weaving shed is schematically shown and indicated by the reference number 1. Reference number 2 indicates the nozzle provided at one end of the weav-

ing shed, to which on the one hand the weft yarn i is supplied by the weft yarn preparation device 3 and which on the other hand is fed with a flowing fluid, e.g. water or pressurized air, from a system 4 comprising a source for the relative fluid and the corresponding control means. Reference number 5 indicates the main driving mechanism of the machine, the drive of the weft yarn preparation device 3 being branched from said main drive mechanism. Reference number 6 indicates a weft detector provided at the end of the weft path of a weft thread through the weaving shed.

In the control system according to FIG. 2 a clock pulse generator 7 feeds an impulse meter 8, which meter is coupled to the machine 5 such that the meter each time is reset to zero and started at the moment in which a weft thread is released for transport through the weaving shed, e.g. by opening a yarn clamp. The meter 8 further is connected to the detector 6 such that the meter is stopped as soon as a signal, supplied by the detector 6, indicates that the head of the relative weft thread has reached the end of its transport path through the weaving shed. The time impulses accumulated in this manner by the meter deliver an output signal s which is a measure for the average velocity at which the weft thread is moved through the weaving shed. The signal s is supplied, if necessary through a smoothing circuit 9, to a comparator 10, to which further a signal n is supplied which is proportionate with the number of revolutions per minute of the main drive mechanism 5. The comparator 10 is adjusted such that it supplies a positive or negative output signal x as soon as the ratio between the input signals s and n deviates upwardly or downwardly respectively with respect to a desired ratio value. If for example the comparator supplies a positive output signal x this means that the weft thread has traversed its path through the weaving shed amply within the time available therefor as determined by the number of revolutions of the machine. This means that the time available for the weft could have been shorter. Therefore the (positive) output signal x is used in that case by a speed control 5*a* to increase the number of revolutions per minute of the driving mechanism 5 such that the available weft time more closely approximates the really necessary weft time, so that the percentage of unused cycle time is kept as low as possible. Otherwise a negative output signal x will be used for slowing down the machine if it appears that the really necessary weft time is longer than the available weft time.

It is to be noted here that "available weft time" means the time in which already a predetermined idle time is included as a safety margin. It is further to be noted that the detector 6 need not necessarily be arranged at the end of the weft path through the weaving shed but in principle could be arranged at any arbitrary position along the weft path. So in principle it is possible to correct the number of revolutions per minute of the machine already during the transport of the relative weft thread.

In the control system according to FIG. 3 those components which correspond to corresponding components in the control system according to FIG. 2 have been indicated by the same reference numbers.

Contrary to the control system according to FIG. 2, in the embodiment according to FIG. 3 reference number 9' indicates a circuit which has been arranged such that through a plurality of successive wefts, e.g. ten wefts, the average weft time is determined. The signal s' which is representative for this average weft time is supplied to a comparator 10', to which further a signal so is supplied, which represents the desired average weft time. The signal difference Δs as supplied by the comparator is supplied through a convertor 11 to the system 4 in order to increase or decrease the pressure or the quantity of the flowing fluid to be supplied to the nozzle 2, dependant on the sign of the correction signal.

We claim:

1. In a method of controlling the operation of a weaving machine in which each weft thread is moved through a shed by means of a flowing fluid, the step of correlating the speed of the movement of each weft thread through the shed with the speed of operation of the weaving machine by

(a) measuring the time occupied by movement of a weft thread through the shed,

(b) generating a first electrical signal which is a measure of such time,

(c) generating a second electrical signal which is a measure of a predetermined fraction of the time occupied by a weaving cycle of the machine,

(d) comparing said electrical signals and generating a third electrical signal which is a measure of the discrepancy between said first and second signals, and

(e) using said third signal to control one of said speeds in order to eliminate the discrepancy between said first and second signals.

2. A method according to claim 1 wherein said third signal is used to control the speed of operation of the weaving machine.

3. A method according to claim 1 wherein said third signal is used to control the flow of said fluid and thus to control the speed of movement of each weft thread through the shed.

4. A method according to claim 3 wherein the first electrical signal is a measure of the average of the times occupied by movement of each of a plurality of successive weft threads through the shed, and the second electrical signal is a fixed target signal.

5. A weaving machine in which each weft thread is moved through a shed by means of a flowing fluid and in which the speed of the movement of each weft thread through the shed is correlated with the speed of operation of the weaving machine, comprising means for measuring the time occupied by movement of a weft thread through the shed, means for generating a first electrical signal which is a measure of such time, means for generating a second electrical signal which is a measure of a predetermined fraction of the time occupied by a weaving cycle of the machine, means for comparing said electrical signals and generating a third electrical signal which is a measure of the discrepancy between said first and second signals, and means responsive to said third signal for controlling one of said speeds to eliminate the discrepancy between said first and second signals.

6. In a weaving machine, the combination comprising

a weft inserting means for moving weft thread through a shed at a given speed;

first means for generating a first signal in response to the measured time occupied during the movement of said weft thread through the shed;

second means for generating a second signal corresponding to the operating speed of the weaving machine;

a comparator connected to said first means and said second means to receive and compare said first signal and said second signal and to generate a third signal which is a measure of the discrepancy between said first and second signals; and

means connected to said comparator to receive said third signal to adjust the speed of insertion of the weft thread relative to the speed of the weaving machine in response to said third signal.

* * * * *

TRIBUNAL DE GRANDE INSTANCE DES ETATS-UNIS
POUR LE DISTRICT EST DE L'ETAT DU TEXAS
ARRONDISSEMENT DE TYLER

SULZER TEXTIL A.G. et SULZER TEXTILE, INC.,	§ §	
Demandeurs constitués en partie civile	§	
contre	§	N° DE L'AFFAIRE _____
	§	PLAINTE POUR VIOLATION
PICANOL NV,	§	DE BREVET
	§	DEMANDE DE JURY
Défendeur	§	

PLAINTE ORIGINALE DES DEMANDEURS

Les Demandeurs Sulzer Textil A.G. et Sulzer Textile, Inc. (collectivement « SULZER »), allèguent, dans leur plainte portée contre le Défendeur Picanol NV (« PICANOL ») les faits suivants :

PARTIES

1. Le Demandeur Sulzer Textil A.G. est une société dûment constituée en vertu des lois suisses et sise à CH-8630 Rüti (Suisse).

2. Le Demandeur Sulzer Textile, Inc. est une société dûment constituée en vertu des lois de l'état de la Caroline du Sud et sise à Spartanburg (Caroline du Sud).

3. SULZER est informé, croit et, compte tenu de ces considérations, allègue, que le Défendeur, Picanol NV, est une société constituée en vertu des lois belges et sise à Polenlaan 3-7, 8900 Ieper (Belgique).

JURIDICTION

4. Le présent Tribunal est compétent en la matière conformément aux articles 1331 et 1338(a) du code américain 28 U.S.C., la présente action relevant du droit américain des

brevets, et notamment de l'article 271 *et seq.* du code américain 35 U.S.C. Le Tribunal a juridiction personnelle sur le Défendeur en ce que le Défendeur a établi des contacts minimaux avec le tribunal et que l'exercice de juridiction sur le Défendeur n'enfreindrait pas aux notions traditionnelles d'équité et de justice substantielle.

LIEU DU PROCES

5. Le lieu du procès est légitime dans le présent District conformément à l'article 1391(d) du code américain 28 U.S.C.

VIOLATION DU BREVET AMERICAIN N° 4,450,876

6. SULZER incorpore par mention et allègue de nouveau les paragraphes un à cinq ci-dessus.

7. Le 29 mai 1984, le brevet américain n° 4,450,876 (« brevet '876 ») a été dûment et légalement délivré pour une invention intitulée Méthode de tissage sur machine à tisser fonctionnant avec buse de déviation pour fluide d'écoulement de transport. Le Demandeur Sulzer Textil A.G. est le cessionnaire et propriétaire du brevet '876.

8. Sulzer Textile, Inc. jouit du droit exclusif au brevet '876. Le brevet '876 est présumé valide conformément à l'article 282 du code américain 35 U.S.C. Une copie exacte et conforme du brevet '876 est jointe aux présentes en Annexe A et incorporée aux présentes par mention.

9. Selon toute information et croyance, PICANOL a violé et continue de violer le brevet '876, a incité et continue d'inciter d'autres à violer le brevet '876 et a commis et continue de commettre des actes de violation concourante du brevet '876. Ces actes illicites comprennent, sans s'y limiter, l'importation, la vente et/ou l'offre de vente aux Etats-Unis de matériel de tissage

et pièces de rechange associées. PICANOL est chargé de violation du brevet '876 conformément à l'article 271 du code américain 35 U.S.C.

10. Les actes de violation commis par PICANOL ont causé des dommages à SULZER et SULZER a droit de recouvrer auprès de PICANOL les dommages encourus par SULZER à la suite des actes illicites de PICANOL d'un montant sujet à preuve à établir au procès.

11. La violation par PICANOL des droits exclusifs de SULZER aux termes du brevet '876 continuera à endommager et porter préjudice irréparable aux activités commerciales de SULZER pour lequel il n'existe aucune voie de recours adéquate sauf sur prescription du présent Tribunal.

12. Selon toute information et croyance, la violation par PICANOL du brevet '876 était volontaire et délibérée, donnant droit à SULZER à des dommages majorés aux termes de l'article 284 (à concurrence de trois fois le montant original) et aux honoraires d'avocat et frais de représentation encourus dans l'engagement des poursuites conformément à l'article 285 du code américain 35 U.S.C.

VIOLATION DU BREVET AMERICAIN N° 4,446,893

13. SULZER incorpore par mention et allègue de nouveau les paragraphes un à cinq ci-dessus.

14. Le 8 mai 1984, le brevet américain n° 4,446,893 ((« brevet '893 ») a été dûment et légalement délivré pour une invention intitulée Méthode de transport d'un fil de trame au travers de la foule de tissage d'une machine à tisser par l'intermédiaire d'un fluide d'écoulement et Machine à tisser adaptée à l'application de cette méthode. Le Demandeur Sulzer Textil A.G. est le cessionnaire et propriétaire du brevet '893. Sulzer Textile, Inc. jouit du droit exclusif au brevet '893. Le brevet '893 est présumé valide conformément à l'article 282 du code américain

35 U.S.C. Une copie exacte et conforme du brevet '893 est jointe aux présentes en Annexe B et incorporée aux présentes par mention.

15. Selon toute information et croyance, PICANOL a violé et continue de violer le brevet '893, a incité et continue d'inciter d'autres à violer le brevet '893 et a commis et continue de commettre des actes de violation concourante du brevet '893. Ces actes illicites comprennent, sans s'y limiter, l'importation, la vente et/ou l'offre de vente aux Etats-Unis de matériel de tissage et pièces de rechange associées. PICANOL est chargé de violation du brevet '893 conformément à l'article 271 du code américain 35 U.S.C.

16. Les actes de violation commis par PICANOL ont causé des dommages à SULZER et SULZER a droit de recouvrer auprès de PICANOL les dommages encourus par SULZER à la suite des actes illicites de PICANOL d'un montant sujet à preuve à établir au procès.

17. La violation par PICANOL des droits exclusifs de SULZER aux termes du brevet '893 continuera à endommager et porter préjudice irréparable aux activités commerciales de SULZER pour lequel il n'existe aucune voie de recours adéquate sauf sur prescription du présent Tribunal.

18. Selon toute information et croyance, la violation par PICANOL du brevet '893 était volontaire et délibérée, donnant droit à SULZER à des dommages majorés aux termes de l'article 284 (à concurrence de trois fois le montant original) et aux honoraires d'avocat et frais de représentation encourus dans l'engagement des poursuites conformément à l'article 285 du code américain 35 U.S.C.

DEMANDE DE JURY

19. Les Demandeurs SULZER TEXTIL A.G. et SULZER TEXTILE, INC. demandent respectueusement un procès avec jury sur tous les litiges.

DEMANDE DE REPARATIONS

EN FOI DE QUOI le Demandeur, SULZER, demande qu'un jugement soit rendu et cherche à obtenir des réparations à l'encontre de PICANOL comme suit :

(a) Une décision judiciaire établissant que les brevets '876 et '893 ont été et continuent à être violés par PICANOL ;

(b) Une comptabilité de tous les dommages encourus par SULZER à la suite des actes de violation commis par PICANOL ;

(c) Des injonctions préliminaires et permanentes interdisant les actes susmentionnés de violation commis par PICANOL, ses administrateurs, agents, préposés, employés et avocats, et personnes agissant de concert avec PICANOL, y compris toutes personnes physiques et morales apparentées, clients, représentants, ensembliers, concessionnaires et distributeurs ;

(d) Des dommages-intérêts compensatoires, ainsi qu'un intérêt antérieur au jugement, selon preuve établie ;

(e) Des dommages majorés conformément à l'article 284 du code américain 35 U.S.C. et

(f) L'ordonnance d'honoraires d'avocat conformément à l'article 285 du code américain 35 U.S.C. ou tel qu'autrement permis par la loi.

Le tout respectueusement soumis,

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Duane H. Mathiowetz
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Par : O L Carroll

Otis Carroll
N° d'inscription au barreau 03895700

AVOCATS POUR LA PARTIE CIVILE
SULZER TEXTIL A.G.
et SULZER TEXTILE, INC.

United States Patent [19]
van Mullekom

[11] 4,450,876
[45] May 29, 1984

[54] METHOD FOR WEAVING ON A WEAVING MACHINE OPERATING WITH A BLOWING NOZZLE FOR A FLOWING TRANSPORT FLUID

[75] Inventor: Hubert P. van Mullekom, Deurne, Netherlands

[73] Assignee: Ruti-te Strake B.V., Netherlands

[21] Appl. No.: 390,850

[22] Filed: Jun. 22, 1982

[30] Foreign Application Priority Data

Jul. 2, 1981 [NL] Netherlands 8103184

[51] Int. Cl.³ D03D 47/30
[52] U.S. Cl. 139/435; 139/450
[58] Field of Search ..... 139/1 R, 435, 336.4, 139/450; 242/27, 28, 29; 226/97; 66/137 R

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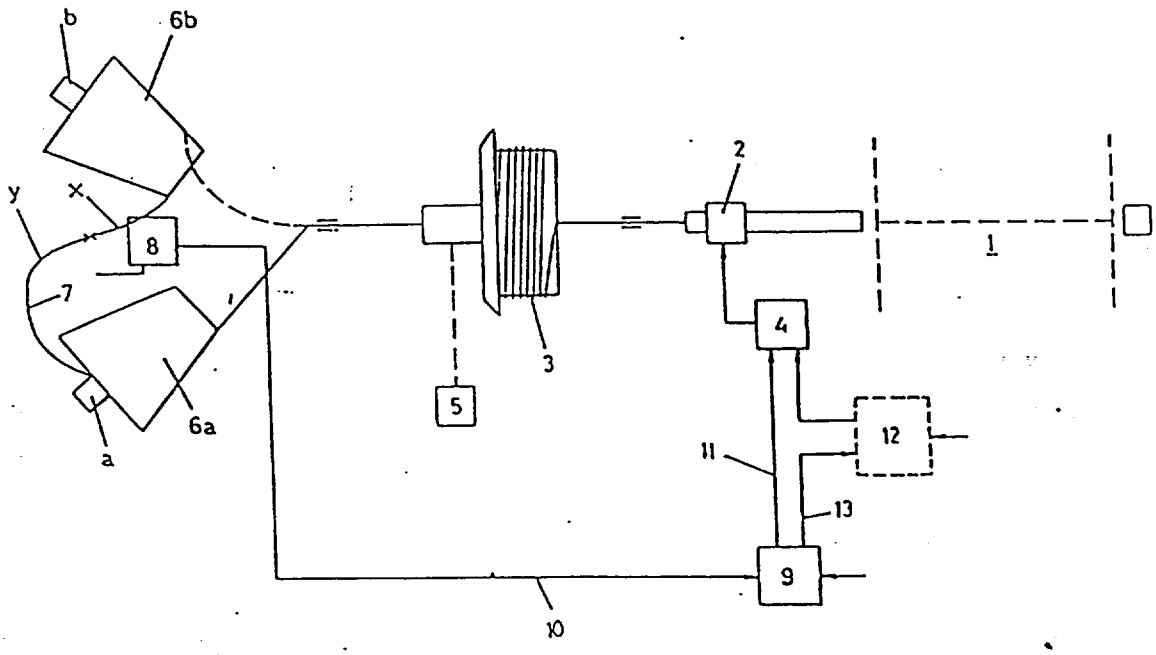
1092947 11/1967 United Kingdom 139/450

Primary Examiner—Henry Jaudon
Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis

[57] ABSTRACT

The impulse transmission of the transporting fluid to the weft yarn may be different, also with yarns of the same type, through different causes, particularly when a switching takes place from one yarn packet to a next yarn packet. According to the invention this switching is now detected in that the yarn section constituting the connection between both packets moves past a detector which emits a signal whereby the feed pressure for the blowing nozzle launching the weft threads into the weaving shed is temporarily varied.

3 Claims, 1 Drawing Figure



METHOD FOR WEAVING ON A WEAVING MACHINE OPERATING WITH A BLOWING NOZZLE FOR A FLOWING TRANSPORT FLUID

The invention relates to a method for weaving on a weaving machine operating with a blowing nozzle for a flowing transport fluid, in which the weft threads are measured and withdrawn from successive yarn packets.

In weaving machines in which the transport of the weft yarn through the weaving shed takes place through the intermediary of a flowing fluid, generally air, differences may occur due to different causes in the impulse transmission from the transporting fluid to the weft yarn. So the impulse transmission with smoother yarn is less effective than with the more fibrous yarns. In this case there are clear causes which may be traced back to differences in surface condition with different types of weft yarns. Besides, however, there are also cases in which the causes are less clear, e.g. if differences in weft time are established, which must be attributed to variations in the impulse transmission, with weft threads of the same type of yarn which are transported under seemingly equal circumstances.

Proposals have already been made for compensating the variations in the impulse transmission of the transport fluid to the successive weft threads, occurring with the same type of weft yarn, by automatically adapting the feed pressure of the blowing nozzle and/or automatically adapting the machine number of revolutions, in order thereby to achieve an approximately constant weft time or a weft time which is a substantially constant portion of the momentary weft cycle time which is determined by the number of revolutions. In this connection reference may be made to the proposal described in the Dutch patent application No. 7908357.

Further experiments now have led to the recognition that, beside a more trendlike variation in the impulse transmission, although seemingly spontaneous changes in impulse transmission may occur and that a variation of this last mentioned type particularly may be expected around the moment in which the relative weft yarn packet has been consumed and the switch is made to a next yarn packet which earlier has been arranged by the weaver ready for use in a reserve station of the machine and therefore was tied with its head end to the tail end of the yarn packet being in use. The invention now aims at compensating the influence of the yarn packet change on the weft time interval.

According to the invention this aim is achieved in that the switching to a next yarn packet is detected and as a reaction to the detection signal a temporary change of the feed pressure of the blowing nozzle is caused.

Generally the switching to the reserve yarn packet will tend to temporary increase the weft time so that then in accordance with the proposal of the invention a temporary increase of the feed pressure of the blowing nozzle will have to be applied.

In a practical embodiment the yarn section that constitutes the connection, after the tying together, between the yarn packet being in use and the reserve yarn packet, is placed in a position from which the weft yarn may be withdrawn when the switching to the reserve packet takes place, through a detection zone in the direction of the blowing nozzle.

The invention likewise relates to a weaving machine whereby the method as described above may be performed.

The weaving machine according to the invention comprises at least one blowing nozzle, fed by a flowing transport fluid, for transporting the weft yarn through the weaving shed, and a weft preparation device which measures the successive weft threads and withdraws them from a stationary yarn packet, besides that yarn packet provisions being present for supporting a reserve yarn packet. The machine according to the invention is characterized by a detection device positioned in the zne between those yarn packets in such a position that the yarn section bridging the yarn packets tied together is drawn, when the switching takes place of the packet being in use to the reserve packet, along the detection device, the output of said detection device being connected to the control element for the feed pressure of the blowing nozzle.

The invention is hereunder further illustrated with reference to the schematic drawing of an embodiment given as an example.

In the FIGURE the portion of the weaving machine containing the weaving shed is schematically indicated by the reference number 1. Reference number 2 indicates the blowing nozzle arranged at one end of the weaving shed, to which nozzle on the one hand the weft yarn i is supplied by the weft preparation device 3 and which on the other hand is fed with a flowing fluid, e.g. pressurized air, from a system 4 comprising a source for the relative fluid and the corresponding control means, such as a pressure reduction valve. The drive of the weft preparation device 3 is derived in known manner from the main drive 5 which has been schematically indicated. The device 3 withdraws the weft yarn from a stationary yarn packet *6a* constituted by a cone received on a support shaft a. Beside the yarn packet *6a* a reserve yarn packet *6b* has been provided which is received on a second support shaft b and the head end x of which has been tied to the tail end y of the yarn packet *6a*. Both yarn packets *6a* and *6b* thereby are mutually connected by a yarn section 7.

In the area between the yarn packets an e.g. electrically operated detection device 8 has been provided. The drawing shows the situation in which the yarn section 7 has been placed by the weaver in a leaving position in the detection device 8. As soon as now the yarn packet *6a* has been consumed the yarn section is drawn from the detection device along the yarn path indicated with broken lines and the switch is made to the reserve packet *7b*. Therewith the pick-up (not further shown) of the detection device is passed which generates a signal which is supplied to an electronic circuit 9. Said circuit is adapted to supply, as a reaction to the received signal 10, during a predetermined, if necessary adjustable time interval, a control signal to the system 4. Thereby the pressure reduction valve belonging to the system 4 is adjusted during that time interval to a different, e.g. higher value which likewise may be adjustable in dependence on the yarn to be used and on other parameters.

The drawing further shows an electric control circuit 12 which during normal weaving operation controls the feed pressure of the weft transporting device 2. The influence of said circuit which may be in the embodiment according to the principle as described in the Dutch patent application No. 7908357, may be deleted during the operative period of the circuit 9 thrugh a signal 13 emitted by the circuit 9.

I claim:

1. A method for weaving on a weaving machine operating with a blowing nozzle for a flowing transport fluid, in which weft threads are measured and withdrawn from successive yarn packets, characterized in that the switching to a next yarn packet is combined with a temporary change in the feed pressure of the blowing nozzle.

2. A method according to claim 1 characterized in that the yarn section which, after the typing up, constitutes the connection between the yarn packet being in use and a reserve packet, is placed in a leaving position from which the weft yarn is caused to be withdrawn via a detection zone when switching to the reserve packet takes place.

3. A weaving machine comprising at least one blowing nozzle fed by a flowing transport fluid, for transporting the weft yarn through the weaving shed, and a weft preparation device measuring the successive weft threads and withdrawing them from a stationary yarn packet, in which besides a yarn packet provisions are present for arranging a reserve yarn packet, characterized by a detection device arranged in the zone between both yarn packets in such a position that the yarn section bridging the yarn packets which have been tied together, is drawn, when the switch is made from the packet being in use to the reserve packet, along the detection device, the output of said detection device being connected to the control element for the feed pressure of the blowing nozzle.

* * * * *

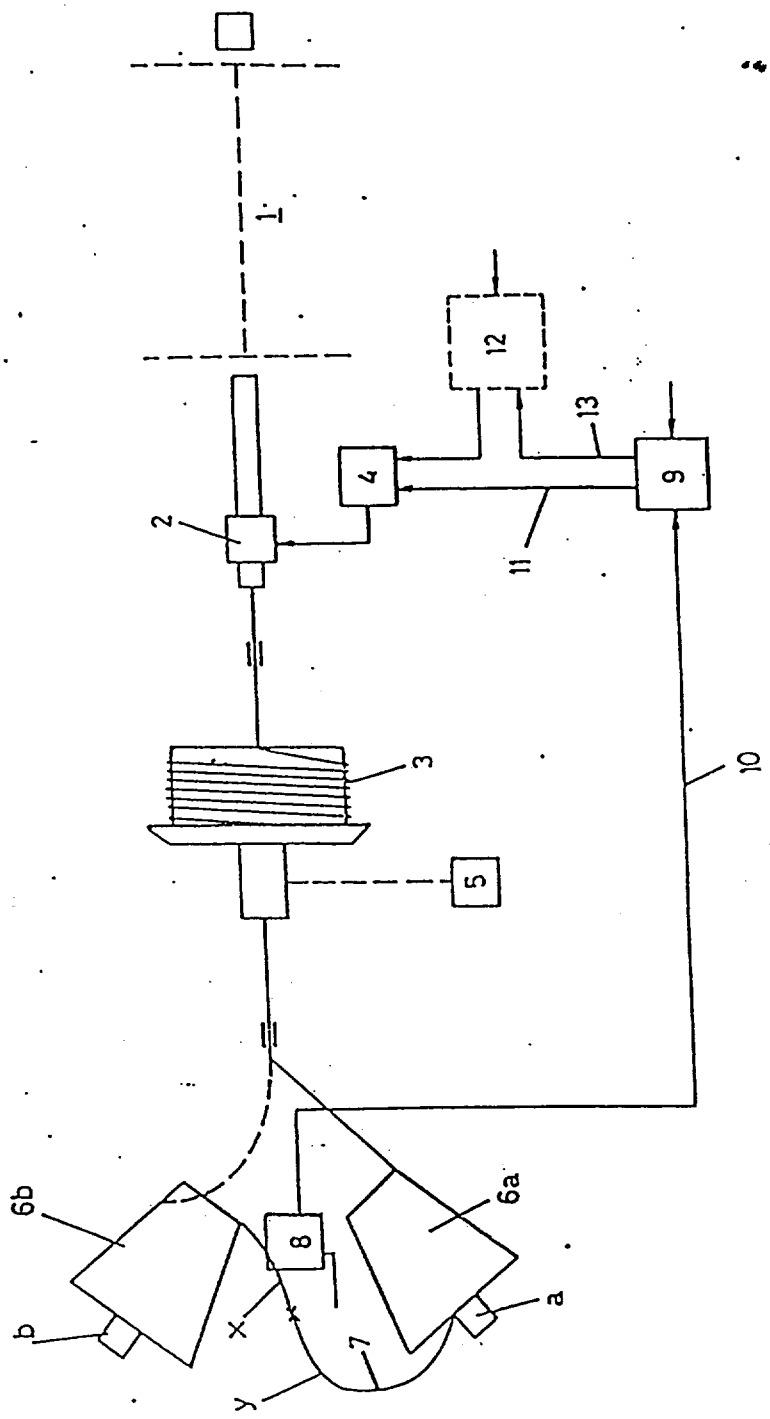

1
12
13
4
9
2
11
3
10
5
6b
6a
8
b
x
x
a
7
y

FIG.1

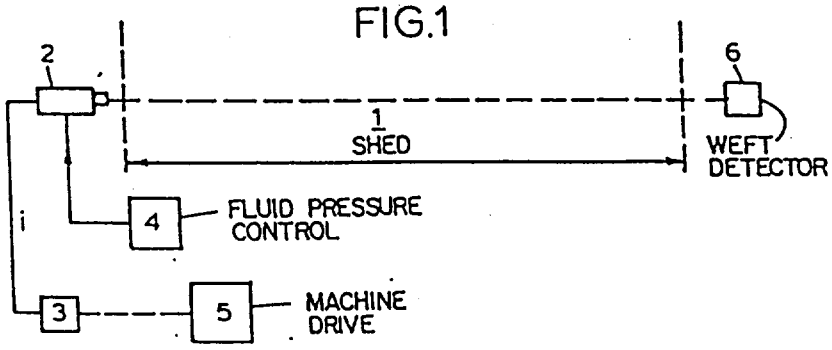


FIG.2

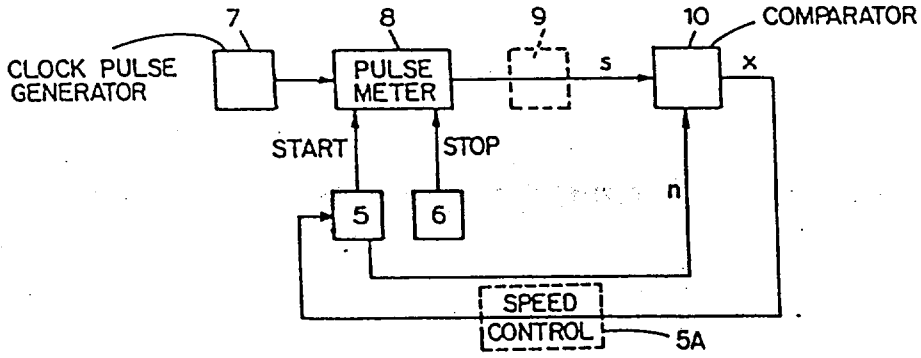
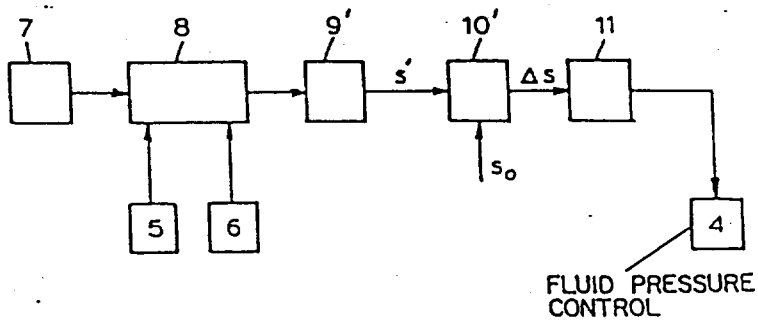


FIG.3



METHOD FOR TRANSPORTING A WEFT THREAD THROUGH THE WEAVING SHED OF A WEAVING MACHINE THROUGH THE INTERMEDIARY OF A FLOWING FLUID, AND WEAVING MACHINE ADAPTED FOR THE APPLICATION OF THIS METHOD

The invention relates to a method for transporting a weft thread through the weaving shed of a weaving machine through the intermediary of a plurality of nozzles fed with a flowing transport fluid.

In the present state of the art considerably higher transport velocities may be achieved with weft systems operating through a flowing transport fluid than with other types of weft transport systems. Particularly pneumatic weaving machines may thereby operate at considerably higher numbers of revolutions than weaving machines provided with different weft transport systems.

For obtaining as high as possible thread velocities in the weft transport through a flowing fluid one is dependent on a correct pulse transmission of the transport fluid to the weft yarn. Many structural measures have already been proposed in order to optimalize the conditions for the best possible pulse transmission with yarns of different type (such as smoother yarns and more fibrous yarns). It is also known to adapt the machine to a new weft yarn if in such a weft transport system a change is made to a different kind of weft yarn, e.g. by differently adjusting the pressure in one or more of the nozzles and adapting the number of revolutions of the machine to the velocities attainable with this new weft yarn.

Apart from the highest possible transport velocity of the weft yarn it is at least as important for the correct and efficient operation of the weaving machine that the successive weft threads have finished their weft movement with the least possible variations on predetermined points of time within the complete weaving cycle. A weft thread arriving too early as well as too late within the relative weaving cycle at the end of its weft movement may produce errors in the cloth. In practice therefore up till now the operation is such that within the weaving cycle a so wide time tolerance for the weft is permitted and so much transport fluid energy is supplied that one is practically sure that the slowest as well as the quickest weft thread will remain within this marginal difference. However, this method of operation is far from economical.

Therefore the invention aims at proposing measures for removing this disadvantage. Extensive experiments have led to the recognition that the differences found in weft periods and transport velocity respectively between successive wefts of the same weft yarn mainly originate in the yarn itself and particularly are the result of the variation in the air resistance of the yarn.

Using this recognition the invention now proposes to use the quantity which is representative for the behaviour of the weft yarn, such as its velocity, as the control quantity for controlling the weaving machine. Therein the operation may be according two different principles.

According to a first principle the transport velocity of each weft thread is measured, a signal, which is representative for the measured transport velocity, is supplied to a control system, in which this signal is converted into a control signal which changes the machine's number of revolutions per minute such that the time period necessary for the weft transport of a thread constitutes a substantially constant portion of the momentary weaving cycle time determined by the number of revolutions per minute. Thereby one achieves that the machine may operate at each moment with the highest possible number of revolutions, namely with a number of revolutions which is as high as permitted by the weft thread moving at that moment through the weaving shed.

According to a second principle the transport velocity of each weft thread is measured, a signal which is representative for the measured transport velocity is supplied to a control system, in which this signal is converted into a control signal which influences the components of the weft transport system governing the velocity of the weft yarn. Therein a constant number of revolutions per minute of the machine is used and one aims at obtaining a constant weft time period by said control.

A particular control according to the second principle is characterized according to the invention in that one carries out continuous measuring of the time used for the weft transport, determines the average weft time period of a number of successive wefts and compares this time with the desired weft time period, in which a signal which is representative for the time difference to be measured, is supplied to a control system in which this signal is converted into a control signal which influences the components of the weft transport system determining the velocity of the weft yarn.

In this manner the conditions for the most efficient use of the weaving machine are established in that e.g. at each point of time the nozzles are fed with only so much flowing fluid of such a pressure that the desired weft velocity is accurately produced. As soon as the continuous measuring of the weft time observes a decreasing trend of the weft time, this means that apparently less energy for the weft transport is necessary, whereafter a corresponding signal is supplied to the transport system until thereafter an increasing trend of the weft time is observed.

It has been found that in such a weft transport system, which automatically has a narrow control according to this method, the number of weft errors is essentially less and thereby the cloth quality is essentially improved.

Further by this method the possibility exists to have the machine automatically adjust itself to the new weft yarn when a change to a different type of weft yarn takes place, by simply supplying a new operation signal which is representative for the weft time period desired with this type of weft yarn.

The invention is illustrated hereunder with reference to the drawing showing two embodiments as examples.

FIG. 1 shows a diagram of a weaving machine of the type in which the weft transport takes place through the intermediary of a jet of a flowing fluid, such as water or air;

FIG. 2 shows a block diagram of a first embodiment of the control system according to the invention, to be applied to the machine according to FIG. 1, and

FIG. 3 shows a block diagram of the second embodiment of the control system according to the invention to be applied to the machine according to FIG. 1.

In FIG. 1 the portion of the weaving machine containing the weaving shed is schematically shown and indicated by the reference number 1. Reference number 2 indicates the nozzle provided at one end of the weav-

ing shed, to which on the one hand the weft yarn i is supplied by the weft yarn preparation device 3 and which on the other hand is fed with a flowing fluid, e.g. water or pressurized air, from a system 4 comprising a source for the relative fluid and the corresponding control means. Reference number 5 indicates the main driving mechanism of the machine, the drive of the weft yarn preparation device 3 being branched from said main drive mechanism. Reference number 6 indicates a weft detector provided at the end of the weft path of a weft thread through the weaving shed.

In the control system according to FIG. 2 a clock pulse generator 7 feeds an impulse meter 8, which meter is coupled to the machine 5 such that the meter each time is reset to zero and started at the moment in which a weft thread is released for transport through the weaving shed, e.g. by opening a yarn clamp. The meter 8 further is connected to the detector 6 such that the meter is stopped as soon as a signal, supplied by the detector 6, indicates that the head of the relative weft thread has reached the end of its transport path through the weaving shed. The time impulses accumulated in this manner by the meter deliver an output signal s which is a measure for the average velocity at which the weft thread is moved through the weaving shed. The signal s is supplied, if necessary through a smoothing circuit 9, to a comparator 10, to which further a signal n is supplied which is proportionate with the number of revolutions per minute of the main drive mechanism 5. The comparator 10 is adjusted such that it supplies a positive or negative output signal x as soon as the ratio between the input signals s and n deviates upwardly or downwardly respectively with respect to a desired ratio value. If for example the comparator supplies a positive output signal x this means that the weft thread has traversed its path through the weaving shed amply within the time available therefor as determined by the number of revolutions of the machine. This means that the time available for the weft could have been shorter. Therefore the (positive) output signal x is used in that case by a speed control 5*a* to increase the number of revolutions per minute of the driving mechanism 5 such that the available weft time more closely approximates the really necessary weft time, so that the percentage of unused cycle time is kept as low as possible. Otherwise a negative output signal x will be used for slowing down the machine if it appears that the really necessary weft time is longer than the available weft time.

It is to be noted here that "available weft time" means the time in which already a predetermined idle time is included as a safety margin. It is further to be noted that the detector 6 need not necessarily be arranged at the end of the weft path through the weaving shed but in principle could be arranged at any arbitrary position along the weft path. So in principle it is possible to correct the number of revolutions per minute of the machine already during the transport of the relative weft thread.

In the control system according to FIG. 3 those components which correspond to corresponding components in the control system according to FIG. 2 have been indicated by the same reference numbers.

Contrary to the control system according to FIG. 2, in the embodiment according to FIG. 3 reference number 9' indicates a circuit which has been arranged such that through a plurality of successive wefts, e.g. ten wefts, the average weft time is determined. The signal s' which is representative for this average weft time is supplied to a comparator 10', to which further a signal s_0 is supplied, which represents the desired average weft time. The signal difference Δs as supplied by the comparator is supplied through a convertor 11 to the system 4 in order to increase or decrease the pressure or the quantity of the flowing fluid to be supplied to the nozzle 2, dependant on the sign of the correction signal.

We claim:

1. In a method of controlling the operation of a weaving machine in which each weft thread is moved through a shed by means of a flowing fluid, the step of correlating the speed of the movement of each weft thread through the shed with the speed of operation of the weaving machine by

(a) measuring the time occupied by movement of a weft thread through the shed,

(b) generating a first electrical signal which is a measure of such time,

(c) generating a second electrical signal which is a measure of a predetermined fraction of the time occupied by a weaving cycle of the machine,

(d) comparing said electrical signals and generating a third electrical signal which is a measure of the discrepancy between said first and second signals, and

(e) using said third signal to control one of said speeds in order to eliminate the discrepancy between said first and second signals.

2. A method according to claim 1 wherein said third signal is used to control the speed of operation of the weaving machine.

3. A method according to claim 1 wherein said third signal is used to control the flow of said fluid and thus to control the speed of movement of each weft thread through the shed.

4. A method according to claim 3 wherein the first electrical signal is a measure of the average of the times occupied by movement of each of a plurality of successive weft threads through the shed, and the second electrical signal is a fixed target signal.

5. A weaving machine in which each weft thread is moved through a shed by means of a flowing fluid and in which the speed of the movement of each weft thread through the shed is correlated with the speed of operation of the weaving machine, comprising means for measuring the time occupied by movement of a weft thread through the shed, means for generating a first electrical signal which is a measure of such time, means for generating a second electrical signal which is a measure of a predetermined fraction of the time occupied by a weaving cycle of the machine, means for comparing said electrical signals and generating a third electrical signal which is a measure of the discrepancy between said first and second signals, and means responsive to said third signal for controlling one of said speeds to eliminate the discrepancy between said first and second signals.

6. In a weaving machine, the combination comprising

a weft inserting means for moving weft thread through a shed at a given speed;

first means for generating a first signal in response to the measured time occupied during the movement of said weft thread through the shed;

second means for generating a second signal corresponding to the operating speed of the weaving machine;

a comparator connected to said first means and said second means to receive and compare said first signal and said second signal and to generate a third signal which is a measure of the discrepancy between said first and second signals; and

means connected to said comparator to receive said third signal to adjust the speed of insertion of the weft thread relative to the speed of the weaving machine in response to said third signal.

* * * * *

United States Patent [19]

Gunneman et al.

[11] 4,446,893

[45] May 8, 1984

[54] METHOD FOR TRANSPORTING A WEFT THREAD THROUGH THE WEAVING SHED OF A WEAVING MACHINE THROUGH THE INTERMEDIARY OF A FLOWING FLUID, AND WEAVING MACHINE ADAPTED FOR THE APPLICATION OF THIS METHOD

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[21] Appl. No.: 205,013

[22] Filed: Nov. 7, 1980

[30] Foreign Application Priority Data

Nov. 15, 1979 [NL] Netherlands 7908357

[51] Int. Cl.³ D03D 41/00

[52] U.S. Cl. 139/11; 139/116; 139/435

[58] Field of Search 139/116, 435, 452, 370.2, 139/11

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[57] ABSTRACT

The speed of the movement of each weft thread through the shed is correlated with the speed of operation of the weaving machine by measuring the time occupied by movement of a weft thread through the shed, generating a first electrical signal which is a measure of such time, generating a second electrical signal which is a measure of a predetermined fraction of the time occupied by a weaving cycle of the machine, comparing said electrical signals and generating a third electrical signal which is a measure of the discrepancy between the first and second signals, and using the third signal to control one of such speeds in order to eliminate the discrepancy between the first and second signals.

6 Claims, 3 Drawing Figures